Short communication

The prevalence of malnutrition according to the new ESPEN definition in four clinically relevant populations

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Abstract

Background & Aims: International consensus on the definition of malnutrition has not yet been reached. Recently, the European Society for Clinical Nutrition and Metabolism (ESPEN) proposed a new consensus definition of malnutrition. The aim of the present study was to describe the prevalence of malnutrition according to the new ESPEN consensus definition in four clinically relevant populations: acutely ill middle-aged patients, geriatric outpatients, healthy old individuals and healthy young individuals.

Methods: The recently released ESPEN consensus definition of malnutrition was applied to the four different populations. This definition consists of two different options: option one requires body mass index (BMI, kg/m^2) <18.5 kg/m^2 to define malnutrition. Option two requires the combined finding of unintentional weight loss (mandatory) and at least one of either reduced BMI or low fat free mass index (FFMI, kg/m^2). Unintentional weight loss could be either >10% of habitual weight independent of time, or >5% over the previous 3 months. Reduced BMI is defined as <20 kg/m^2 or <22 kg/m^2 in subjects younger and older than 70 years, respectively. Low FFMI is <15 kg/m^2 and <17 kg/m^2 in females and males, respectively. Only individuals for whom all data on diagnostic options were complete were included in the present analysis: acutely ill middle-aged patients (n=349), geriatric outpatients (n=135), healthy old individuals (n=306) and healthy young individuals (n=179).

Results: According to the new ESPEN consensus definition of malnutrition, the prevalence of malnutrition ranged from 1% in healthy old individuals to 15% in the acutely ill middle-aged patients. The different options that compose the new ESPEN consensus definition of malnutrition were represented in the four populations in various ways, i.e., high prevalence rates of low FFMI in all four populations, a relatively high prevalence of BMI <18.5 kg/m^2 in healthy young individuals but low prevalence of BMI <18.5 kg/m^2 in all other populations and relatively low prevalence rates of the combination of weight loss with either low BMI or low FFMI.

Conclusions: Combining the diagnostic options that compose the new ESPEN consensus definition of malnutrition results in prevalence rates lower than expected in acutely ill middle-aged patients and geriatric outpatients. In contrast, healthy young individuals are (most likely falsely) defined malnourished based on a low BMI <18.5 kg/m^2. Future studies should further determine the cut-off

points for FFMI and BMI in older persons. In addition, the association of the new ESPEN consensus definition of malnutrition with clinically relevant outcomes needs further study.

Keywords: Malnutrition, definition, prevalence

Introduction

Malnutrition is an increasingly recognized problem that is associated with morbidity, mortality, and increased costs of care. To enhance early recognition and treatment of malnutrition, an easy and widely accepted definition of malnutrition is necessary. Such a definition should be easy applied for all health care professionals and in all health care settings. Furthermore, the definition of malnutrition should be widely accepted to be able to compare prevalence rates among health care settings and countries, and to improve communication among health care providers and politicians worldwide.

International consensus on the definition of malnutrition has not yet been reached. Recently, the European Society for Clinical Nutrition and Metabolism (ESPEN) proposed a new consensus definition including two options for the diagnosis of malnutrition(1). The first diagnostic option requires a low body mass index (BMI), following the recommendation by the World Health Organization: subjects are defined as malnourished if they have a BMI <18.5 kg/m^2(2). The second diagnostic option encompasses unintentional weight loss (>10% independent of time or >5% in the last three months), always combined with either a low BMI (<20 kg/m^2 if <70 years old or <22 kg/m^2 if ≥70 years old) or a low Fat Free Mass Index (FFMI). Given the increasingly recognized importance of body protein reserves, the preferred diagnostic trajectory involves the assessment of the FFMI, with cut-off points of 15 kg/m^2 for women and 17 kg/m^2 for men.

As the new ESPEN consensus definition of malnutrition has been released only recently, validation studies have not yet been published. The aim of the present study was to describe the prevalence rates of malnutrition according to the newly proposed ESPEN consensus definition of malnutrition in four clinically relevant populations including acutely ill middle-aged patients, geriatric outpatients, healthy old individuals and healthy young individuals. This study will provide a first overview of the applicability of the newly proposed consensus definitions of malnutrition in various target populations.

Methods

The recently released ESPEN consensus definition of malnutrition (see Fact box 1), was applied to four different populations. Only individuals for whom all data on diagnostic options were complete were included for the present analysis.

Population 1: acutely ill, middle-aged patients

This population consisted of 349 patients (57.6 years, SD 17.7) who were admitted to a general internal ward (general internal medicine, gastroenterology, dermatology, rheumatology, nephrology) or a general surgical ward (general surgery and surgical oncology) of the VU University Medical Center (Amsterdam, the Netherlands) in two periods respectively from April 2002 until October 2002 and from February until June 2003 (3).

Population 2: geriatric outpatients

This population consisted of 135 geriatric outpatients (80.8 years, SD 7.3) who were referred to the geriatric outpatient clinic of the Bronovo Hospital (The Hague, the Netherlands) for a comprehensive geriatric assessment due to mobility problems between March 2011 and January 2012 (4).

Population 3 and 4: healthy old individuals and healthy young individuals

The European MYOAGE study consisted of old and young healthy individuals. Individuals in the MYOGE study were recruited from five different sites across Europe, including: Manchester, UK; Paris, France; Leiden, the Netherlands; Jyväskylä, Finland and Tartu, Estonia. Data was collected between 2010 and 2013(5).

Old and young healthy individuals from the MYOAGE study were analysed separately; included were 306 healthy old individuals (74.4 years, SD 3.3) and 179 healthy young individuals (23.4 years SD 2.9).

Individuals in all four populations were screened with the Short Nutritional Assessment Questionnaire (SNAQ), with ≥ 3 points indicating high risk of malnutrition (3). Independent of the SNAQ screening results the diagnosis of malnutrition was assessed by measured weight and height, calculated BMI, self-reported unintentional weight loss; FFMI was derived differently across the populations. In the acutely ill middle-aged population FFMI was assessed using Xitron 4000B multiple frequency Bio-electrical Impedance Spectroscopy, using its 50KHz frequency and the Geneva equations (6). In geriatric outpatients, FFM was assessed using a direct segmental multi-frequency Bio-electrical Impedance Analyser, which provided direct values for FFM, which were then divided by height^2 (InBody 720, Biospace Co., Ltd, Seoul, Korea). In both the old and young healthy individuals FFMI was assessed with dual-energy x-ray absorptiometry.

The prevalence of malnutrition according to the new ESPEN consensus definition, as well as to the individual diagnostic options, was calculated for each population.

Results

Screening with SNAQ (≥ 3 points) identified 105 acutely ill middle-aged patients at risk of malnutrition, 14 geriatric outpatients, 1 healthy old individual and none of the healthy young individuals. Assessment according to the new ESPEN definition (independent of initial screening with SNAQ) yielded 54 malnourished patients (15%) in the acutely ill, middle-aged patients, 10 malnourished geriatric outpatients (7%), 3 malnourished healthy old (1%) and 14 malnourished healthy young (8%). Five malnourished patients in the acutely ill middle-aged were not identified to be at risk by the initial SNAQ screening; this was 2 in the geriatric outpatients, 3 in the healthy old and 14 in the healthy young.

Table 1 depicts the prevalence data for each population. Furthermore, it shows the prevalence of the individual diagnostic options of the definition. For example: in the acutely ill middle-aged population, the prevalence of malnutrition was 15%. Out of the total population of 349 individuals, 116 had a FFMI below the proposed cut-off points; 44 individuals (13%) out of these 116 were defined as malnourished, based on the combination low FFMI and unintentional weight loss.

Figures 1A and 1B display the overlap of the new ESPEN consensus definition of malnutrition and its individual diagnostic options in the acutely ill middle-aged population and in the geriatric outpatient population. Overlap figures are not displayed for the healthy old individuals and healthy young individuals due to low number of malnourished cases in the healthy old individuals (n=3) and unilateralism in healthy young individuals (n=14 of which 13 were identified malnourished by having only a low BMI). Furthermore, in the healthy old individuals low BMI and low FFMI were never combined with unintentional weight loss.

Discussion

The description of the prevalence of malnutrition according to the recently released ESPEN consensus definition showed relatively low prevalence rates of malnutrition in all four populations. A low BMI and a low FFMI were observed in approximately 20% of the individuals in each population. However, most individuals were eventually not identified as malnourished as low BMI/low FFMI was not combined with unintentional weight loss. Thus, the criterion of unintentional weight loss has a dominant influence when determining prevalence rates.

The first diagnostic option of the new ESPEN consensus definition of malnutrition consists of a BMI < 18.5 kg/m^2. A BMI < 18.5 kg/m^2 was mostly observed in acutely ill middle-aged patients. However, both in geriatric outpatients and in healthy old individuals, a BMI less than 18.5 kg/m^2 was rare (1% in each population). Thus, a BMI < 18.5 kg/m^2 is rare in older individuals, which is in line with other studies that report higher BMI's in older populations (7).

Thirteen (7%) young healthy individuals were defined malnourished according to a low BMI. The ESPEN diagnostic process suggests screening first, and further assessment only for those at risk. In the cohorts described, we used the SNAQ for initial screening. This resulted in no young healthy individuals at risk. i.e. no need for further assessment. However, recent research has shown that the SNAQ is not a valid screening tool for outpatients as it does not comprise BMI (8). If we had used MUST (9), for example, the 13 healthy individuals would have passed screening and been identified malnourished in the process of diagnosis, most likely falsely, as they were all selected for their excellent health. They were probably 'healthy and slim' or very athletic.

The second diagnostic option of the new ESPEN consensus definition of malnutrition consists of a combination of unintentional weight loss and either low BMI or low FFMI. In the acutely ill middle-aged population, 25% of all patients had unintentional weight loss. This is in line with expectations, as unintentional weight loss is a frequently described phenomenon accompanying acute disease. However, only 15% of the population was defined as malnourished according to the new ESPEN consensus definition of malnutrition, indicating that in 10% of the cases unintentional weight loss did

not occur in combination with a low BMI or a low FFMI. We believe that the infrequent concurrence of unintentional weight loss with low BMI (30 out of 54 malnourished acutely ill middle-aged patients) is due to the relatively high BMI's at the population level. The combination of unintentional weight loss and a low FFMI was present in 44 out of the 54 malnourished acutely ill patients.

In the geriatric outpatient population the combination of unintentional weight loss and low BMI (<22 kg/m^2 if ≥70 years old) (9 out of 10 malnourished outpatients) overlapped reasonably well with the combination of unintentional weight loss and low FFMI (8 out of 10 malnourished outpatients).

As the new definition suggests that unintentional weight loss should be combined with either a low BMI or a low FFMI to be defined as malnourished, this also suggests that a low BMI and a low FFMI can be used interchangeably. Although in geriatric outpatients, malnutrition based on low BMI or on low FFMI was equivalent, the correspondence in the acutely ill patients was lower. Larger numbers of patients are required, however, to determine how well BMI and FFMI correlate in different populations.

A low FFMI was highly prevalent (14-33%) in all populations, however prevalence of the combination of unintentional weight loss and low FFMI showed a lower prevalence (0-13%). The high prevalence of a low FFMI may be explained by the chosen cut-off points in the ESPEN consensus definition of malnutrition. The cut-off point of FFMI below 15 kg/m^2 for women represents the 50^{th} percentile, according to Schutz's reference tables (10). For men, a cut-off point of FFMI below 17 kg/m^2 represents the 10^{th} percentile, which is probably a much more realistic percentile to apply. This raises the question of whether the cut-off point for women should be amended, for example to 14 kg/m^2, which represents the 10^{th} percentile for women (10), and what consequences that cut-off point would have for the prevalence rates. A future study should look into a possible revision of the FFMI cut-off points, their overlap with unintentional weight loss and the consequences for malnutrition prevalence rates.

Of the acutely ill middle-aged patients with a BMI <20 kg/m^2 (<70 years) or <22 kg/m^2 (≥70 years), approximately half were defined as malnourished as they also met the second diagnostic option: unintentional weight loss. In the geriatric outpatient population a low BMI (<20 kg/m^2 (<70 years) or <22 kg/m^2 (≥70 years)) occurred in 28 (21%) outpatients. Remarkably, in only 9 (7%) geriatric outpatients a low BMI was combined with unintentional weight loss; this might be one explanation for the lower than expected prevalence rates in this geriatric outpatient population. Previous studies have reported prevalence rates of malnutrition in approximately 50% of geriatric outpatients (11-13). Since geriatric outpatients usually suffer from multiple age-related problems and many co-morbidities, unintentional weight loss is most likely a problem that has occurred only slowly and thereby has not reached the cut-off level of 10%, or that has gone by unnoticed. In the healthy old individuals, 39 (13%) had a BMI <20 kg/m^2 (<70 years) or <22 kg/m^2 (≥70 years) but none were defined as malnourished based on the concurrence with unintentional weight loss; three healthy old individuals were defined as malnourished based on a BMI <18.5 kg/m^2. For older persons, either a BMI cut-off point higher than 22 kg/m^2 or a different cut-off point for unintentional weight loss are more reasonable indicators of malnutrition.

Conclusion:

The prevalence rates of positive scores when using the different ESPEN consensus definitions of malnutrition were high. However, when combining the different diagnosis pathways, the prevalence rates were lower than expected in acutely ill middle-aged patients and in geriatric outpatients. Old healthy individuals were probably identified as malnourished too infrequently, due to missing concurrence of low BMI/low FFMI and weight loss, whereas in contrast young healthy individuals were (most likely falsely) defined malnourished based on a low BMI.

Some suggestions for further studies:

- To study the importance of the relative contribution of unintentional weight loss versus low BMI or low FFMI in the new ESPEN consensus definition of malnutrition.

- To reconsider the proposed cut-off points for FFMI, specifically for women. Both absolute cut-off points and age- and sex- specific percentiles should be studied.

- To study whether a low BMI and a low FFMI are interchangeable and whether this is different between populations.

- To evaluate the proposed BMI cut-off point of < 22 kg/m^2 or the degree of unintentional weight loss in older adults. This descriptive study even raises the question whether BMI is a relevant parameter for nutritional status in older adults at all or whether we should more strongly rely on FFMI in older adults.

In future analyses, we will report on the association between the new ESPEN consensus definition of malnutrition, its individual diagnostic options and clinically relevant outcome measures such as functionality and survival, which will shed a further light on the chosen cut-off points for BMI and FFMI.

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291 **Attachments:**

292 - Fact box: Two alternative ways to diagnose malnutrition.

293 - Figure 1A and 1B: The overlap of the new ESPEN consensus definition of malnutrition
294 and its individual diagnostic options in acutely ill middle-aged patients and geriatric
295 outpatients.

296 - Table 1: Prevalence rates of malnutrition according to the new ESPEN consensus
297 definition and to its individual diagnostic options in four populations.

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Fact box: Two alternative ways to diagnose malnutrition.

Before diagnosis of malnutrition is considered it is mandatory to fulfil criteria for being "at risk" of malnutrition by any validated risk screening tool.

Alternative 1:

- BMI <18.5 kg/m^2

Alternative 2:

- Weight loss (unintentional) >10% indefinite of time, or >5% over the last 3 months combined with either
- BMI <20 kg/m^2 if <70 years of age, or <22 kg/m^2 if ≥70 years of age

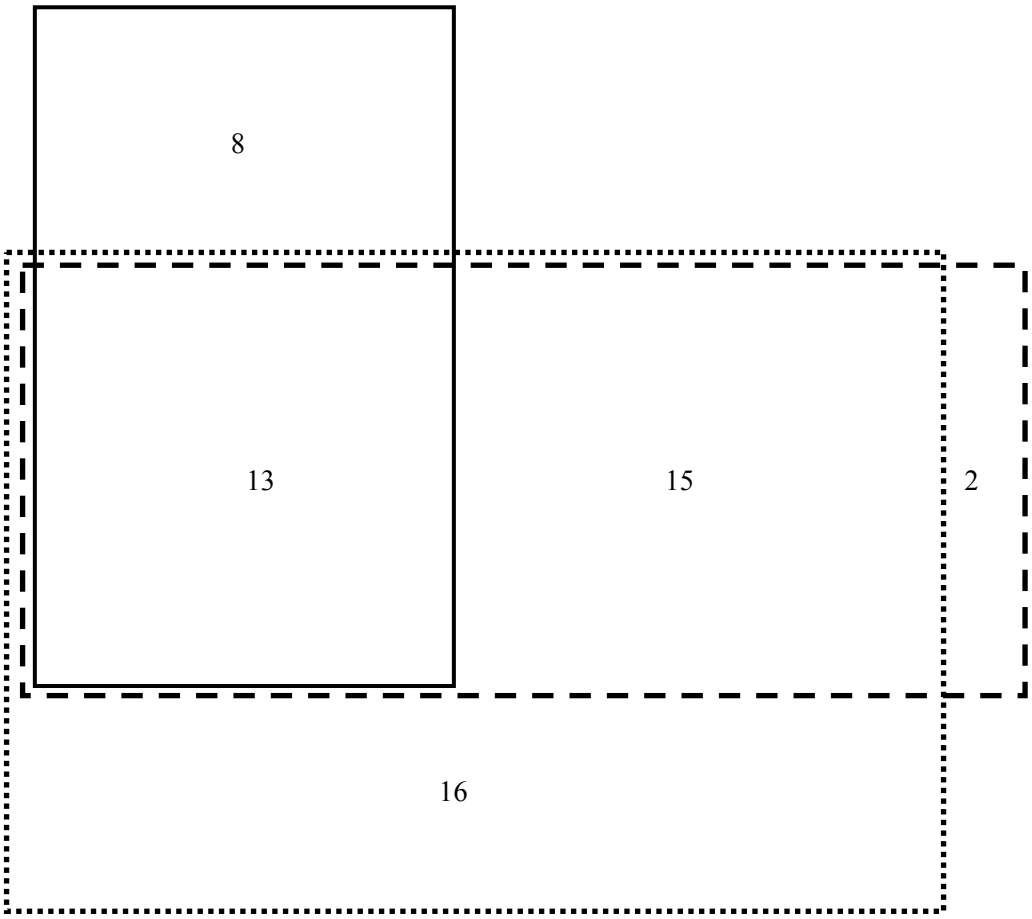
  or
- FFMI <15 and 17 kg/m^2 in women and men, respectively.

Figure 1A and 1B: The overlap of the new ESPEN consensus definition of malnutrition and its individual diagnostic options in acutely ill middle-aged patients and geriatric outpatients.

1A: Acutely ill middle-aged patients N = 349

Of the 54 malnourished patients (new ESPEN diagnostic options):

BMI < 18.5 kg/m^2	N=21
Unintentional weight loss + low BMI <20 kg/m^2 (<70 years) or 22 kg/m^2 (≥70 years)	N=30
Unintentional weight loss + low FFMI <15 kg/m^2 (females) or 17 kg/m^2(males)	N=44



1B: Geriatric outpatients N = 135

Of the 10 malnourished outpatients (new ESPEN diagnostic options):

——— BMI < 18.5 kg/m^2 N=2

– – – Unintentional weight loss + low BMI <20 kg/m^2 (<70 years) or 22 kg/m^2 (≥70 years) N=9

····· Unintentional weight loss + low FFMI <15 kg/m^2 (females) or 17 kg/m^2 (males) N=8